

CloudSat: It's a go!

By DIANE AINSWORTH

JPL has been selected to manage a new spaceborne radar capable of peering deep into the interior of clouds to study their structure, composition and impact on climate and weather. The CloudSat mission has been selected by NASA for flight in 2003.

"The science community, which for years has been calling for a radar mission that would allow them to study the vertical structure and composition of clouds, was absolutely jubilant when they heard the news," said Deborah Vane, deputy principal investigator for CloudSat at JPL. "With this mission, our ability to model clouds and how they impact climate and weather will improve substantially. Clouds are the biggest uncertainty in climate prediction models and the most significant source of errors, so selection of Cloudsat after six years of work to design the mission was extremely gratifying."

CloudSat will use a millimeter-wavelength radar and an infrared spectrometer to measure the altitude and properties of clouds. The spaceborne cloud-profiling radar will be able to "slice" through the atmosphere providing a cross-sectional view of the clouds. While existing weather satellites can only image the uppermost layer of clouds, CloudSat will provide a completely new observational capability from space.

"We really don't know how much water and ice clouds contain or how much heat they absorb," said Thomas Livermore, CloudSat project manager at JPL. "This mission will greatly improve our understanding of global atmospheric circulation, the way in which energy from the Sun and water is moved from the atmosphere to the ground and back into the atmosphere. That lack of information limits scientists' models for predicting weather and climate."

CloudSat Principal Investigator Dr. Graeme Stephens, a professor of Atmospheric Sciences at Colorado State University, worked closely with a team of JPL researchers, engineers, and managers, led by Vane, to design and propose CloudSat to the NASA Earth System Science Pathfinder (ESSP) program. The program, launched in 1995, funds the development of innovative, low-cost Earth observation missions capped at \$120 million in real-year dollars.

CloudSat's primary goal will be to compile a database of cloud measurements that will assist

researchers in improving the way clouds are represented in global climate and numerical weather prediction models. Spectrometer data and measurements from the radar—which will be able to measure water and ice content and profile the vertical structure of different types of clouds at 94 gigaHertz, or wavelengths of 1,000 megaHertz—will help elucidate processes that form clouds and assess their sensitivity to climate change. The ultimate goal is to improve the long-term predictive accuracy of climate and weather models.

CloudSat will coordinate its measurements with two other NASA missions, namely the PICASSO-CENA space-based cloud and aerosol lidar and one of the Earth Observing System series missions, known as EOS-PM, which will carry microwave and optical sensors. The satellites will be launched together on a Delta II rocket from Vandenberg Air Force Base and will be able to coordinate measurements by flying in formation in a 700-kilometer (434-mile) orbit. Precision orbit adjustments will be used to steer CloudSat along the orbit of the other two spacecraft, creating a virtual space armada dedicated to gathering data on the Earth's atmosphere. Beyond establishing the feasibility of flying multiple spacecraft in formation, CloudSat will furnish a series of important technology demonstrations for future scientific, civilian and tactical space-based forecast systems.

Under Stephens' leadership, JPL will manage an international team to implement CloudSat. Ball Aerospace in Boulder, Colo., will build the CloudSat spacecraft. The Canadian Space Agency is developing some of the key radar components, such as the radio receiver, front-end electronics and critical 94 gigaHertz radio frequency output amplifier, as well as contributing their scientific expertise. JPL will manage the radar and near-infrared spectrometer instrument developments. Scientists from the United States, Germany, Canada and Japan will use data from the mission to develop new models for predicting cloud formation and weather cycles.

Responsibility for ground operations to command the spacecraft and route science data to the data processing center will be managed by the U.S. Air Force. Science data processing will take place at the Cooperative Institute for Research in the Atmosphere at Colorado State University. The cloud measurements will be validated by compar-

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CloudSat will provide a completely new observational capability from space, whereas existing weather satellites can only image the uppermost layer of clouds.

Engineers check MGS obstruction

By MARY HARDIN

Engineers conducted a test April 23 on JPL's Mars Global Surveyor spacecraft to check the temperature of the hinges on the high-gain telecommunications antenna in an attempt to understand if part of a thermal blanket might have been obstructing its movement. The spacecraft remains in good health and the science instruments are turned off while engineers analyze the hinge.

While engineers continue to study the nature of the obstruction, they plan to proceed with the mapping mission this week. The science instruments were turned back on Wednesday, April 28, and the next day the spacecraft was scheduled to begin a one-week mapping campaign with the antenna in a fixed position.

On May 6, when Mars and the Earth are at favorable angles from each other, the spacecraft will return to a normal mapping mission that will use the antenna in its steerable mode to send continuous data to Earth.

Flight controllers say they could conduct a normal mapping mission through February 2000, when the geometry between Mars and Earth again becomes unfavorable, with telecommunications

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News Briefs

Dr. Linda Spilker, deputy project scientist on the Cassini mission, has been inducted into the Placentia-Yorba Linda Unified School District's Hall of Fame.

Spilker graduated from Valencia High School in Placentia in 1973.

A 22-year JPL employee, Spilker is the recipient of numerous awards, including NASA's Exceptional Service Medal and the agency's Scientific Achievement Award for her work on the Voyager mission, and Distinguished Alumna Award for Natural and Social Sciences from Cal State Los Angeles. □

NASA's Occupational Health and Employee



Dr. Linda Spilker

Assistance Office is providing all NASA centers an opportunity to participate in the National Depression Screening Project as part of a program to educate, prevent mental illness and help employees cope with potentially stressful situations.

All JPL employees, retirees and their families are eligible to participate in the project by calling (800) 390-7302 until Dec. 31, 1999, according to JPL employee assistance counselor **Cynthia Cooper**. All calls are confidential and anonymous.

On May 5, the JPL Employee Assistance Program is sponsoring a talk on "Anxiety and Depression" with Dr. Charles Barr, a Pasadena psychologist who specializes in anxiety disorders. The talk will be held in Building 180-703C at noon.

The JPL Employee Assistance Program is part of Occupational Health Services and provides confidential assistance on such issues as family problems, chemical dependency, work-

related problems, stress and financial concerns. For more information, call ext. 4-3680 or go online to <http://eis.jpl.nasa.gov/medical>. □

The Mars Surveyor 2001 mission is sponsoring a contest to pick its new logo to illustrate the orbiter, lander and rover that will be the next visitors to Mars.

"The logos can be done individually for the orbiter, lander and rover or incorporate all three aspects into one design," said **Cathy Davis**, Mars Exploration Program outreach coordinator. "They can be any shape and color, and may include the spacecraft, the planet Mars, and/or the surface of Mars."

Entries for the logo contest are due June 30, 1999. Winners will be announced Aug 2.

Mail entries to Mars Outreach, mail stop 264-380. Entries can also be sent to Davis by e-mail. For questions, call her at ext. 4-6111.

The winner(s) will be acknowledged with a picture and biographical information posted by JPL on Mars Surveyor 2001's web site, and

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Special Events Calendar

Ongoing

Alcoholics Anonymous—Meeting at 11:30 a.m. Mondays, Tuesdays, Thursdays (women only) and Fridays. Call Occupational Health Services at ext. 4-3319.

Codependents Anonymous—Meets at noon every Wednesday. Call Occupational Health Services at ext. 4-3319.

Gay, Lesbian and Bisexual Support Group—Meets the first and third Fridays of the month at noon in Building 111-117. Call employee assistance counselor Cynthia Cooper at ext. 4-3680 or Randy Herrera at ext. 3-0664.

Parent Support Group—Meets the fourth Tuesday of the month at noon. Call Jayne Dutra at ext. 4-6948.

Senior Caregivers Support Group—Meets the second and fourth Wednesdays of the month at 6:30 p.m. at the Senior Care Network, 837 S. Fair Oaks Ave., Pasadena, conference room #1. Call (626) 397-3110.

Friday, April 30

"The Chemistry of Life: Protein Machines"—Caltech professors Douglas Rees and Stephen Mayo will speak at 4 p.m. in the campus' Baxter

Lecture Hall. An abstract and list of other seminars are available online at http://www.cco.caltech.edu/~koonin/CCE0_1seminars.html.

JPL Dance Club—Meeting at noon in Building 300-217.

Fri., Apr. 30—Sat., May 1

Capitol Steps—This ensemble of current and former congressional aides that presents political satire in the form of song parodies will perform at 8 p.m. in Caltech's Beckman Auditorium. Tickets are \$32, \$28 and \$24. Call (626) 395-4652.

Tuesday, May 4

JPL Gamers Club—Meeting at noon in Building 301-227.

JPL Genealogy Club—Meeting at noon in Building 301-169.

Wednesday, May 5

Associated Retirees of JPL/Caltech Board—Meeting at 10 a.m. at the Caltech Credit Union, 528 Foothill Blvd., La Cañada.

ICIS Talk—Ruth Bergman of Section 311 will discuss Extensible Markup Language, an emerging World Wide Web standard. Benefits from the standard

include separation of data from presentation, commercial product support, improved search capability, platform independence, ease of use and ease of maintenance. This talk will focus on how and why people are using the standard and how it can be used at JPL. At noon in von Kármán Auditorium.

Investment Advice—A Fidelity representative will be available for individual investment and retirement counseling. To schedule an appointment, call (800) 642-7131.

JPL Drama Club—Meeting at noon in Building 301-127.

"Markets as Information-Gathering Tools"—Dr. Charles Plott, professor of economics and political science at Caltech, will speak at 8 p.m. in the campus' Beckman Auditorium. Admission is free. Call (626) 395-4652.

Russian Language Workshop—Meets from 7 to 9 p.m. on the Caltech campus. Some knowledge or previous study of the language is essential. Call Joyce Wolf at ext. 4-7361.

Thursday, May 6

An Evening with Mark Shields—The political commentator will appear at 8 p.m. in Caltech's Beckman Auditorium. Admission is free. Call (626) 395-4652.

JPL Gun Club—Meeting at noon

in Building 183-328.

SESPD Lecture Series—Stardust Mission Director Tom Duxbury will speak at 11 a.m. in von Kármán Auditorium.

Friday, May 7

JPL Dance Club—Meeting at noon in Building 300-217.

San Jose Taiko—This group's performance fuses traditional Japanese drumming with Latin, Brazilian and African rhythms. At 8 p.m. in Caltech's Beckman Auditorium. Tickets are \$29, \$25 and \$21. Call (626) 395-4652.

"The Chemistry of Life: Electron Flow in Biological Systems"—Caltech professors Rudolph Marcus, Harry Gray and Jacqueline Barton will speak at 4 p.m. in the campus' Baxter Lecture Hall.

Sunday, May 9

Chamber Music—Gregory Lawrence Jefferson will perform flute at 3:30 p.m. in Caltech's Dabney Lounge. Admission is free. Call (626) 395-4652.

Tuesday, May 11

JPL Stamp Club—Meeting at noon in Building 183-328.

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QuikScat now at Vandenberg; May 29 launch set

By DIANE AINSWORTH

JPL's Quick Scatterometer (QuikScat) satellite has arrived at Vandenberg Air Force Base to begin final preparations for launch atop a Titan II rocket May 29 at 7:15 p.m. Pacific Daylight Time.

The spacecraft will be prepared for its ascent into space in one of Vandenberg's payload processing facilities. Final assembly of the spacecraft will include four days of battery conditioning to ensure that all power systems are operating; final testing of the SeaWinds scat-

terometer; and spacecraft system testing to check out all onboard operations, such as power, data and guidance and control.

The spacecraft will be moved to Space Launch Complex 4 West overlooking the Pacific Ocean on May 16 and placed on the Titan II launch vehicle. The rocket, a decommissioned intercontinental missile, has been refurbished to supply 19,350 kilograms (43,000 pounds) of thrust at liftoff.

With its own onboard propellant, the QuikScat satellite will weigh 870 kilograms (1,910 pounds). Launch is planned to take place

Fast response keeps Champollion on track

By JOHN G. WATSON

Engineering ingenuity and dawn-to-dusk efforts over the past few weeks have resulted in a successful and lifesaving redesign of Space Technology 4/Champollion, a proposed mission to land on a comet nucleus.

The mission will feature a single spacecraft instead of a mother ship and lander as part of newly announced, reconfigured mission architecture.

Some of JPL's most creative solutions come out of the crucible of rigid budget and engineering constraints, and Space Technology 4/Champollion has emerged from the fire a leaner and meaner mission.

Changes in the mission plan will allow Space Technology 4/Champollion to accomplish all of its technology validation and science goals while working within budget limits of approximately \$158 million, excluding launch costs and operations.

Earlier plans had assumed that industry and/or government agencies would partner with the project in some key areas of technology. When such partners failed to materialize, the mission was faced with a significant funding shortfall.

On March 19, NASA headquarters formally requested a plan on how the ambitious comet rendezvous mission could be kept at its roughly \$158 million cap.

Project Manager Brian Muirhead and his team rolled up their sleeves and got to work. "Within one week, the team had brainstormed, developed 18 pages of options, narrowed them down, arrived at what we thought was the most likely option to succeed and fleshed that option out," Muirhead said. "We then took two more weeks to detail the concept, estimate its mass and cost it."

A successful pair of presentations to NASA's Office of Space Science on April 8 and 14 led to reauthorization for JPL to proceed with formulating the mission based on the concept as presented.

"The ST4/Champollion team developed a revised mission plan that was capable of meeting the budget constraints," Muirhead said. "We went from a two-spacecraft paradigm to a single spacecraft, which gives us a simpler set of hardware that's easier to test on the ground. The new design is more robust, and our chances of a successful landing are as good or better than they were before.

"We received offers of support from all over the Lab, especially the technical divisions," he added. "JPL is really at its best when it's focused on supporting a project during a crisis."

The lifesaving transformation of the mission recalls similar resurrections of past JPL missions that had been threatened with cancellation. The Galileo mission, for example, was completely replanned several times due to changes made in launch configurations and upper stages, most dramatically after the Space Shuttle Challenger accident in 1986. The Cassini mission, too, was completely restructured in 1992 in response to a new budget squeeze and the cancellation of its sister mission, Comet Rendezvous Asteroid Flyby.

Attempting a feat never done before, Space Technology 4/Champollion will land on a comet's nucleus after surveying and mapping it for several months. The key to the success of this mission is a suite of 10 technologies that must work together as a system to deliver a payload safely to the surface of an active comet. These technologies—including multi-engine ion propulsion (building from Deep Space 1), a large, 10-kilowatt, high-efficiency solar array using inflatables and precision guidance and landing using a miniature scanning laser altimeter—have wide application to other future space science missions.

Once on the surface, the spacecraft will take images of its surroundings, drill for material below the surface of the nucleus and perform scientific experiments to determine the composition of this untouched material from the original solar nebula.

For further details about Space Technology 4/Champollion, visit <http://nmp.jpl.nasa.gov/st4>. □

during a 10-minute window from 7:15 to 7:25 p.m. PDT May 29 (03:15 to 03:25 Universal Time May 30). A second 10-minute window will be available at the same time on the following day if launch does not take place on May 29.

Once it reaches its final orbit, QuikScat will be circling Earth every 100 minutes at an altitude of about 800 kilometers (500 miles).

QuikScat will measure the speed and direction of winds near the surface of the world's oceans using its specialized SeaWinds microwave radar instrument during a two-year primary mission. It will provide scientists with accurate, frequent, high-resolution measurements of ocean surface wind speed and direction in clear and cloudy skies. □

Mars '01 to carry sundial

Inscribed with the motto "Two Worlds, One Sun," the first sundial to be sent to another planet will travel to Mars aboard JPL's Mars Surveyor 2001 lander.

The lander's panoramic camera will use features on the sundial as a virtual "test pattern" to help Earth-based operators calibrate the brightness and tint of the camera's images following its arrival on Mars in January 2002. Periodic pictures of the sundial will also reveal the passage of hours and seasons as the Sun moves across the salmon-colored Martian sky.

"Our ancestors made astonishing discoveries about the nature of the heavens and our place in it by closely watching the motion of shadows," said Bill Nye, public television's "The Science Guy," who helped unveil the sundial design April 21 at Cornell University in Ithaca, N.Y. "Now, at the dawn of the next century, we can make observations of new shadows, this time on another planet."

The sundial will be about 8 centimeters (3 inches) square and will weigh a little more than 60 grams (2 ounces). Made of aluminum to minimize its weight, the anodized metal surfaces will be black and gold. Photo etching and engraving will be used to apply lettering and drawings to the face and side panels of the sundial. Four side panels around the sundial's base are engraved with a message for future Mars explorers.

The design of the sundial evolved through suggestions and drawings from children across the United States.

For more information, go online to <http://mars.jpl.nasa.gov/2001> or <http://athena.cornell.edu>. □



CORNELL NEWS SERVICE

The sundial on the Mars 2001 lander will measure 8 centimeters (3 inches) square, and will weigh a little more than 60 grams (2 ounces).

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"will receive the prestige of seeing their creations on the spacecraft, products and documents," Davis said. □

JPL's Public Services Office seeks employees to participate in the annual Shadow Day for Eliot Middle School students on May 18.

Marking its 12th anniversary, the program allows students to observe employees at their jobs, and become aware of

the diverse employment opportunities available at JPL.

Those who participate will host a student from 9:30 a.m. to 1 p.m.

Employees in a variety of jobs are needed to make the program a success. If interested in participating, call the Public Services Office at ext. 4-0112. □

The JPL Chinese Culture Club has begun to offer a Tai Chi class, which will be held at 12:10 p.m. every Thursday in the mall.

To sign up, contact **Ping Wang** at wangp@rockymt.jpl.nasa.gov. □

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Wednesday, May 12

JPL Amateur Radio Club—Meeting at noon in Building 238-543.

JPL Drama Club—Meeting at noon in Building 301-127.

JPL Toastmasters Club—Meeting at 5:30 p.m. in the Building 167 conference room.

Russian Language Workshop—Meets from 7 to 9 p.m. at Caltech. Knowledge or previous study of the language is essential. Call Joyce Wolf at ext. 4-7361.

Friday, May 14

JPL Dance Club—Meeting at noon in Building 300-217.

"The Chemistry of Life: Molecular Recognition"—Caltech professors Dennis Dougherty and Peter Dervan will speak at 4 p.m. in the campus' Baxter Lecture Hall.

Travel Film—Bali and the Spice Islands will be featured in this production at 8 p.m. in Caltech's Beckman Auditorium. Tickets are \$9 and \$7. Call (626) 395-4652.

Fri., May 14—Sat., May 15

Spring Concert—The Caltech Glee Clubs and Caltech Chamber Orchestra will perform a program of spirituals and international music from six continents at 8 p.m. in the campus' Dabney Lounge. Admission is free. Call

(626) 395-4652.

Fri., May 14—Sun., May 16

"Trojan Women"—Theater Arts at Caltech will present this production featuring Caltech students, faculty and staff. To be held 8 p.m. Friday and Saturday, 2 p.m. Sunday. Tickets are \$15. Call (626) 395-4652.

MGS

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limited due to the restricted motion of the antenna hinge. After that, the spacecraft would need to return to mapping with the antenna in a fixed position if the obstruction has not been resolved.

The Surveyor scientists prefer to map with a steerable antenna, as opposed to a fixed antenna, because twice as much data can be returned to Earth in a given period. □

Passings

Donald Lange, 75, a retired senior contract negotiator from the former Section 514, died of heart failure March 17.

Lange worked at JPL from 1967–87. He is survived by his wife, Rena, daughter Karen Hagen, son Donald Jr. and four grandchildren.

Burial was at Riverside National Veterans Cemetery. □

Roy Mennenga, 86, a retired employee from Section 643, died of cancer March 24 at his home in Pasadena.

Mennenga joined the Lab in 1959 and retired in 1975. He is survived by his wife, Mary Ann,

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Fun rules the day for children, parents



Wendy Palsulich of Section 622, and her niece Courtney, at left, check out a 3-D picture in von Kármán Auditorium, while third-grader Sarah Simpson drives a prototype rover with the help of Bob Anderson during Take Our Daughters to Work Day April 22. In addition to visiting parents at their work sites, more than 300 children and other relatives of JPL staff also saw a fuel-cell demonstration and heard a number of presentations and speakers who discussed career opportunities and provided overviews of JPL projects.



TOM WYNNE / JPL PHOTO LAB

“ What CSMT showed us is that the Center of Excellence concept is a very powerful way to get management attention on an area that has strategic importance to the Lab.

[The Centers] are building communities ... helping to decide collectively what is needed to provide the infrastructure, tools and whatever else is needed to get the job done.

JPL's excellence adventure

By MARK WHALEN

JPL's growth in recent years can be attributed in part to its ability to develop the technical expertise and leadership needed to create and implement the cutting-edge missions for which the Laboratory is known. To that end, six "Centers of Excellence" have been established on Lab. They are managed by the Engineering and Science Directorate.

In the first of a series of articles on the centers, Engineering and Science Director Dr. William Weber discusses their development and how they are helping to shape JPL's future.

Question: *How did the Centers of Excellence begin?*

Answer: The model people look at is the Center for Space Microelectronics Technology (CSMT), which started in mid-'80s. The Lab put real emphasis on this, from the standpoint that our NASA sponsor wanted it and the director of the Laboratory, Dr. Lew Allen, wanted it. Once we had that much power behind it, things started happening.

In addition to that recognition at the highest levels, others internally came to recognize microelectronics as being a key technology area for JPL's future—things that could lead to new kinds of sensors for remote sensing, and

many kinds of electronic devices having to do with power and communications. The potential was there and the timing seemed to be right.

The first big thing was the building of the Microdevices Laboratory in the late 1980s. What CSMT showed us is that the Center of Excellence concept is a very powerful way to get management attention on an area that has strategic importance to the Lab.

What was unique about that organization?

Dr. Carl Kukkonen was hired from outside the Laboratory as center leader, not a program manager nor a line manager. He was the leader of a virtual organization, which consisted of people, facilities and capabilities from multiple organizations, programs and funding sources from throughout the Laboratory.

Carl really used his leadership skills to coalesce all of this to work with the technical organizations. Eventually, this led to the creation of real—not just virtual—organizations, with real facilities, real instruments and capabilities. As an example, when the Microdevices Laboratory was built, [the Device Research and Applications] Section 346 was formed. People then moved into that building and got equipment.

On the program side, Carl got NASA funding, and worked very hard to bring about funding from the Department of Defense and other non-NASA sources. The idea of the leader was to make all of this coalesce.

Why is CSMT no longer considered a Center of Excellence?

It still is a Center, but in a more mature form. The CSMT evolved into a program and became institutionalized, if you will. That's another part of the Center of Excellence model: Eventually, these things become part of the ongoing organization—they become part of the line organization and the program offices.

That's certainly a measure of success.

While we keep the title of CSMT under its current leader, Dr. Barbara Wilson, it's done its job, in a sense. It still exists as a program and as a Center.

Following this center's success, how did the current six Centers of Excellence develop?

The Executive Council retreat in 1996 raised the issue of creating other centers; about 10 candidates emerged. It was a major challenge at that time, so the decision was not to create too many.

In '96, the first two were created: the Interferometry Center of Excellence (ICE) and the



Dr. William Weber

Center for In-Situ Exploration and Sample Return (CISSR). There were three more in spring '97: the Center for Integrated Space Microsystems (CISM), Deep Space Communications and Navigation (DESCANSO), and Center for Space Mission Architecture and Design (CSMAD). The newest one is the Center for Mission Information and Software Systems (CSMISS), which was created in February of this year.

Was there serious debate that JPL should not develop these centers?

There was a growing recognition then—as there is this year—that we were about to launch into a realm of new technologies and new kinds of missions we'd never done before. We'd gone through a long period of much larger missions, and we've recognized that era is coming to an end. This is part of that transition to "faster, better, cheaper"—lots of new, small, first-of-a-kind missions. There was also [NASA Administrator] Dan Goldin's desire to introduce lots of new technologies into those missions.

How was the interferometry center a catalyst
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JPL Centers of Excellence

Deep Space Communications and Navigation

Leader: Dr. Catherine Thornton

Integrated Space Microsystems

Leader: Dr. Leon Alkalai

Interferometry

Leader: Dr. Michael Shao

In-Situ Exploration and Sample Return

Leader: Dr. Patricia Beauchamp

Space Mission Architecture and Design

Leader: Steve Wall

Space Mission Information and Software Systems

Leader: Dr. Richard Doyle

Candidates sought for System Architects Program

Centers of Excellence part of the experience for the next generation to design and implement future JPL missions

As the Space and Earth Science Programs Directorate's Architect Development Program enters its fourth year at JPL, it is looking for two or three additional people to join the program in 1999. This two-year internship program aims to identify, recruit and train the next generation of system architects who will design and implement future JPL missions.

The program has completed its planned two-year pilot within SESPD and over the last year has transitioned to the Engineering and Science Directorate, specifically

the Center for Space Mission Architecture and Design, one of six Centers of Excellence at JPL, that are each chartered to foster world-class excellence in a particular technical area of strategic importance to JPL and NASA. The objective of the Center for Space Mission Architecture and Design is to make JPL the clear leader in mission and system level (architectural) conception, design and implementation for space science and Earth science missions.

It is the system architects who are envisioned as playing a major

role at JPL in producing new, innovative missions and spacecraft architectures. The architect must deal with abstractions and political concerns on the one hand and rigid budgets and technology considerations on the other. Traditional scientists, engineers and managers often do not like to deal with things that they cannot get their hands on.

"We need people who can lead the way in changing and improving our processes and ultimately our product, as well as enable a synergy between programs by seeing the bigger picture and planning for the future," said Nick Thomas of SESPD, who managed the Architect Development Program through its pilot years.

For two years, opportunities for trainees in this program include

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CloudSat

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son against measurements made at the U.S. Department of Energy Cloud and Radiation Testbed sites, part of the Department of Energy's Atmospheric Radiation Measurements program.

The CloudSat proposed cost is about \$135 million. NASA will contribute about \$111 million of total mission cost, with the remainder being provided by the Canadian Space Agency, U.S. Department of Energy and U.S. Air Force.

CloudSat is the fourth mission in the ESSP program, managed by the Goddard Space Flight Center, Greenbelt, Md. The other missions are the NASA Vegetation Canopy Lidar mission, PICASSO-CENA mission and Gravity Recovery and Climate Experiment (GRACE). □

Excellence

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in the creation of the other centers?

When Dr. Mike Shao was hired a decade ago, he was one of the world's experts in this very embryonic field. We wanted to get into that field because seeing a planet around another star would be a major scientific advance, and interferometry was one of the techniques for doing that.

When he was named center leader in '96, there wasn't much more than a core group of people and set of activities; what it really needed was what it is today: a lot more key people, facilities, special testbeds, design tools.

It's really helped turn what was a Laboratory curiosity into major missions for the Lab. Interferometry has really blossomed tremendously. It has fulfilled its goals and has matured in the same way as CSMT. We now have real programs, real organizations, real facilities, real projects and technologies. It's done the life cycle. We'll keep the name, because we still want to be excellent in that area, but as an embryonic catalyst, it has done its job.

How do the centers work together?

There is a very strong interconnectedness. The Center for Space Mission Architecture and Design is looking at new techniques and tools for doing architecture and design, from single missions to complex, multi-mission tasks, like we'll be doing at Mars—multiple missions, vehicles, outposts, telecommunications, navigation and other areas.

The center is also looking at overall mission architecture, for planetary missions in particular.

DESCANSO was really an anointing of a mature area—deep space communications and navigation—which was always a center of excellence, it just never had the title.

All of these feed in, in an architectural sense, to the generic challenge of this massive solar system exploration we're doing. NASA has asked us to be its Center of Excellence for deep space systems. Most of our internal centers of excellence support this NASA directive. Interferometry supports our NASA role in the Origins Program.

How are the development of the centers for in-situ exploration/sample return and interferometry similar?

In-situ is still in its embryonic stages; just like interferometry, it's a whole new area for exploration. Focusing in-situ into a center gives it a lot more attention.

In-situ has lots of promise—robotic colonization on planets, rovers, bigger rovers, rovers on all planets, cryobots, aerobots, submersibles, other kinds of robotic vehicles, not to mention all the sample-return work.

Is there any connection between CISM and CSMISS?

Very definitely. We've always had relatively smart spacecraft; in the future we're going to have brilliant spacecraft. Leon Alkalai and CISM are developing systems-on-a-chip for future spacecraft and rovers.

CISM will enable tremendous computing capability onboard

spacecraft and rovers. That implies a degree of software, lines of code and software engineering problems that dwarf the kinds of onboard computing ability we have today. We're not talking about thousands of lines of code, but millions of lines. The software side is where CSMISS comes in. You can think of CISM as the "Intel" and CSMISS as the "Microsoft" of our deep-space computing capability.

How do the centers coexist with

the divisions in terms of structure?

A couple of years ago, Ed Stone coined the phrase "communities for innovation," which is what the centers are really all about. They're building communities, not line organizations. It's bringing the right people in the community together, creating roadmaps for the future, helping to decide collectively what is needed to provide the infrastructure, tools and whatever else is needed to get the job done. □

'Rocket Boys' author visits Lab



TOM WYNN / JPL PHOTO LAB

Homer Hickam, left, author of the book "Rocket Boys," which was adapted to the popular recent movie "October Sky," visits the von Kármán museum area April 26 along with the movie's director, Joe Johnston, center, and JPL Deputy Director Larry Dumas.

Architects

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working on mission proposal responses to announcements of opportunity; working with the Advanced Projects Design Team, Team X (made up of representatives of all major spacecraft and mission subsystems); becoming familiar with JPL tools in the automated design process; working with partners in industry to gain a different perspective on how design is performed; working at other NASA centers; working in project-specific roles; and working in the newly established JPL Centers of Excellence.

The Architect Development Program will select new trainees this spring. Qualities being sought in system architects include strong technical and problem-solving skills, leadership in technical innovation, an ability to be an effective team builder and facilitator, and skills in leading mentoring and helping others succeed. Candidates will be evaluated specifically on the following criteria:

- Excellent technical skills and knowledge;
- Good communication skills;
- Demonstrated innovation and leadership skills;
- Broad-based experience in design and development;

Passings Continued from page 6

and daughter Carolyn Shaw.

Burial was at St. Joseph Cemetery in Redding, Calif. □

Helene Heimlich, 69, a retired administrative clerk from Section 644, died of pneumonia March 27 at Arcadia Methodist Hospital.

Heimlich worked at the Lab from 1964-96. She is survived by daughters Dana Heimlich, Deborah McCarty, Denise Demilo and Dawn Evitts.

Memorial services were held April 5 at St. Mark's Church in Altadena. Burial was private. □

Ralph Hurt, 67, a retired technical manag-

- Experience with flight systems;
- A minimum of five years' work experience since acquiring a bachelor of science degree.

This article is to be considered a formal call for applicants for this program. Applications should consist of a current resume, as well as a one- or two-page paper stating the candidate's interest in applying for the program and why they should be considered for inclusion, and should be submitted to the candidate's division office, as well as to Cliff Anderson, mail stop 301-180. Applications must be received by May 21, 1999. Division management will prescreen candidates from their division and submit a short list to the selection board.

"The selection process will take place during June and July with the third group of trainees being chosen by early July," said Anderson, "so we encourage people who are interested to submit their applications as soon as possible."

Candidates chosen for the program will participate in the planning of their two-year internship, which will be tailored to their individual expertise and interests, but will also include study in areas considered to be crucial to their development as well-rounded system architects. Formal course work that will help participants gain a better understanding of the organizational context of their roles, insight into the NASA community, and more technical knowl-

er from Section 830, died of cancer March 27 at his home in Cameron Park, Calif.

Hurt joined JPL in 1970 and retired in 1996. He is survived by his wife, Kathleen, and daughters Sheri and Tracy.

Burial was at Green Valley Church in Cameron Park. □

Correction

In an April 17 *Universe* article on ISO 9001, the name of ISO team member Peter Barry was misspelled. *Universe* regrets the error. □

edge will be part of the training.

For additional information, contact Anderson at ext. 4-9843 or Thomas at ext. 4-7033, or visit the Architect Development Program home page at <http://eis/adp>. □

Anniversaries

The following employees were honored for 25 or more years of service at JPL during a service award ceremony in von Kármán Auditorium April 1:

45 years: Daniel Bergens

40 years: John Garba, William Harris, Ralf Hastrup, Norman Haynes.

35 years: Lawrence Goforth, Michiko Iwamoto, Richard Laeser, George Lutes Jr., William Peters, Edward Stone, Olivia Tyler.

30 years: Luis Alfaro, Mercedes Campos, Victor Chen, Leticia Eckerle, Pasquale Esposito, Gerald Hintz, Ho-Sen Lin, James Rose, Jack Schwartz, Richard Wetzel.

25 years: Khosrow Bahrami, Ronald Bigelow, Nevin Bryant, Steven Mackenka, Dennis McCreary, Peter Poon, Guillermo Rodriguez, John Scheid, Lyle Skjerve, Gary Spradlin, Clara Thoms, Carroll Winn, Gilbert Yanow, Leslie Zoltan. □

The following employees were honored for 20 years of service during an award ceremony in von Kármán Auditorium April 7:

Noel Burden, Sylvia Chavez, Steven Cole, John Davis, Peter Doms, Katherine Dumas, Aaron Fishman, Donald George, Joyce Grunwald, Rosemary Guerrero, Samad Hayati, Julie Ispirian, Dean Johnson, Chin-Po Kuo, Johnny Kwok, Kurt Liewer, Chi Lin, Guy Man, Charlotte Marsh, Jerry Millard, Frances Mulvehill, Bill Nesmith, Juan Pacheco, Kathie Reilly, Joseph Riedel, Naresh Rohatgi, Douglas Sanders, Theodore Sweetser III, Joan Taylor, Randall Taylor, Philip Turner, Steven Tyler, John Vasbinder, Paul Wagner, Robert Warzynski. □

LETTERS

My family and I would like to express our sincere thanks to our friends in 2X and 5X or their support during the illness and recent passing of my mother Maxine. Your presence at my mother's services was truly appreciated. The flowers, plants and cards of encouragement have been an encouragement during this time of bereavement.

Herald Christian

□□□

I would like to thank all of my fellow JPL employees and contractors who supported me and my family through the death of my sister Donna earlier this year.

Mark Kingsbury

FOR SALE

A/C/HEATER package unit, 3-ton, fully charged and working, removed for new construction, \$1,000/obo. 957-2173.

AIR COMPRESSOR, commercial size, make offer. 957-2173.

APPLIANCES: vacuum cleaner, Hoover, upright, with attachments, good condition, \$70; steam iron, General Electric Power Spray, very good condition, \$25; floor lamp, black base and pole, off-white shade, good condition, \$15. 626/577-8107.

AUDIO EQUIPMENT, top of the line Philips, FR 940, 100W stereo receiver w/variable digital delay, Dolby Pro Logic w/full function remote for complete system; CDC 935, 5-disk carousel CD changer w/digital output and favorite track selection; FC 930, dual-well double auto-reverse cassette deck w/4-motor operation, like new, \$325. 626/359-7666.

BABY ITEMS: cradle with mattress, \$40, baby exersaucer, \$35, other assorted items, good cond. 626/798-6248.

BED, Simmons Majesty mattress, full-sized, good condition, \$25/obo; box spring, full, vg cond., \$40/obo; Fieldcrest comforter, dust ruffle, pillow sham set, full, exc. cond., \$25. 626/577-8107.

BED, twin, teak veneer headboard, exc. mattress, \$250/obo. 790-6261.

BICYCLE RACK, Performance rooftop, holds 3 bikes + 3 wheels, \$150. 562/692-4826, Robert.

BOOTS, western, exc. cond., 3 pair: Nocona fancy black w/silver tips, 9 1/2 D, \$75; Tony Lama plain black, 9D, \$50; Dan Post med. brown/black 9D, \$50. 249-0453, after 5 p.m.

CD PLAYER, JVC 200 carousel, still in box, programmable w/manual, remote control, voice mail/pager, \$230. 626/309-0530. CHINA SET, 60 pieces for \$70/obo. 909/592-0780, Ana.

COFFEE TABLE, circular, glass surface w/brass sides, 27" in diameter, \$35. 310/937-5923.

COFFEE TABLE, white marble, 23 x 69, \$100, 626/797-6982.

COMPUTER, Leading Edge, model D, 2 5.25" 360 kB FD, MS DOS 3.10, Phoenix 8088 ROM, BIOS v.E, 649K RAM, 14" Amber monitor, working, \$25. 541-0062.

COMPUTER, Mac II FX, Conner 30170E HD, 780 KB 3.5" FD, 1.4 MB 3.5" FD, 20 MB RAM, 14" color monitor, Global Village Teleport 33.6 fax/modem, System 7.5.3, 32-bit addressing memory, Netscape Communicator Pro 4.04, \$250. 541-0062.

COUCH, L-shaped, white and blue stripes, very clean; H: 26", Short section 55" x 35", long section (ottoman) 38" x 71"; \$75. 310/937-5923.

CRIB, Simmons, oak, mattress box spring, mattress, sheets/crib toys, \$120. 626/796-8803.

CROCK POT square w/Corningware, \$13/obo. 626/568-8298.

DESK, brown wood, very clean, small and a large (file) drawer on each side, \$25. 310/937-5923.

DINING ROOM FURNITURE: Queen Anne formal dining rm set from Ethan Allen, incl. table (60" x 40" x 29") with 2 leaves (18" each), 6 side chairs, server (40" x 21" x 34"), all in cherry, custom table pads, exc. condition, \$2,600/obo; unrelated 5-piece dinette set (table dimensions 48" x 36" x 29"), \$75. 626/577-8107.

DOG, pure-bred Golden Retriever puppy needs gd home; 3 mo. old female, comes w/hen kennel, e-training (and regular) collar, toys, food, grooming supplies; pd over \$1,000, sell \$650/obo. 626/355-8866.

DOGS, Labrador puppies, 8 wks. old, AKC-OFA, yellow, males, shots, due claws, wormed, female on site, \$400/ea. 626/963-3233.

DRYER, Kenmore electric, like new, \$150/obo, in Pasadena. 626/792-9635 or 818/777-6016.

ENTERTAINMENT CENTER, whitewash, 5' x 4', fits 36-in. TV, stereo, CDs and videos, \$75. 310/937-5923.

ENTERTAINMENT UNIT, pecan, 5 x 6 x 2, 5 shelves, 3 closet compartments, 1 desk, fold-down door, gd cond., \$250/obo. 957-4770.

EXERCISE MACHINES, Voit "Torso Trainer", Model 808; Brenda DyGraf "In-Stride Walker" Model 55-1350; Tony Little "For Women Only" (1-on-1 trainer); \$90/obo for each; get in condition for summer fun early. 790-6283, Bob, after 5 p.m.

EVITA TICKETS, pair of great seats in orchestra section, Sat., May 15, 8 p.m., seats M101 & 102, \$135/pair. 661/255-0149.

FISH, freshwater, large and medium (120-gallon tank for sale when fish gone); price negotiable. 626/794-2758.

FURNITURE, 3-ft. brass lamp w/accordion shade, like new, \$80/obo; 4-ft oak table lamp, like new, \$90/obo; antique cherry coffee table, round w/hinged drop leaves to rectangular, refinished, \$100. 368-8160.

FURNITURE: Dining set: 4-pc. cream-color fabric chairs w/square glass top, exc. cond., \$200.; girl's twin-bed white porcelain iron complete with mattress, exc. cond., \$100. 626/850-3867.

HOCKEY CARDS, '94-'95 complete 225-card set, \$15, stars include Kariya, Messier, Lindros, Gretzky, Jagr, Brett Hull, Kurri, McSorley; BASEBALL & FOOTBALL CARDS, 200 assorted, rookies, stars, inserts, favorite names/teams will be included, \$20. 626/914-6083.

MODEM, Apple Geoport adapter fax/modem, model M1694 express, new, \$25. 541-0062.

MOVIE CAMERA & PROJECTOR, 8mm, little used but old, exc cond. 790-0762.

PHOTOGRAPHS, 40" x 30", color, framed, 2 tall-ship pictures taken by prof. photog., vg cond.; 1 of Spanish tall ship in SF Bay, 1 of German tall ship taken near Puerto Rico; \$70/each, \$120 for both/obo. 626/568-8298.

PICTURE FRAMES, three made of brass, 22" x 28", \$6/each, \$15 for all three/obo. 626/568-8296.

Continued on page 8

PRINTER, Xerox Diablo 630 with wheels/ribbons, excellent condition, \$10/obo. 626/568-8298.

REFRIGERATORS, propane, 1 older Servel with center ice cube compartment, not been used in 6 years; and 1 motorhome model (elec./propane), needs work (freezer acts as refrig.); \$100 each/\$175 both. 760/373-2512.

SAW, Sears radial, 10", accessories included. 790-6738.

SEWING MACHINE TABLE, nice cherry oak, antique?, \$50; COUCHES, 6' white, bamboo frame, \$40, 5' blue plaid, \$30. 626/791-7081.

SOFA, multi-color tapestry in good condition, \$250/obo. 626/969-2134.

SOFA (sleeper), Thomasville queen size, 3-cushion, plaid upholstery, \$350. 790-0335, eves.

SOFA BED, \$175; DINING SET, walnut, \$275; RUG, 9 x 12 wool, \$75; REFRIGERATOR, GE 19 cu. ft., 6-yr old, \$400; COUCH SET, \$400. 241-9979.

SOFA & LOVE SEAT, brand new, Earth tones, oak and gold trim, high back, \$250/obo. 661/722-4032.

STEREO SYSTEM, am/fm w/record players, works, \$35; BOOK, std. handbook for electrical engineers, 1941 edition, \$5. 793-1895, Albert.

SWING SET, 2 stories with 2 tall swings, slide, sunshade & ladder; you disassemble & haul from Valencia area, \$65. 661/297-0219.

TABLES: Coffee table (approx. 60 x 30); matching end table (approx. 24 x 27); exc. quality and condition; oak with leaded glass inserts; \$250/both. 626/296-1537.

TABLES, glass, four 2-shelf tables with brass feet, three make up a coffee table (one round 2.5-ft. dia., two "half-moon"), fourth is round end table (2.5-ft. diameter), \$125/obo. 909/592-0780, Ana.

TELEPHONE ANSWERING MACHINE, General Electric, black, microcassette, voice time/day stamp, hardly used. 626/844-4383.

TELEVISION, RCA ColorTrak, 25-in., \$50; indoor TV antenna (rabbit ears), rotating type, RCA, \$12. 626/577-8107.

VIDEO GAME, Sega Genesis CD and cass. syst., 4 controllers, 21 game cartridges and CDs, \$200 for all/obo. 626/309-0429.

VIDEO TAPES, viewed once, \$4/ea. 310/937-5923.

WEDDING DRESS, excellent condition, used once, kept in garment bag; white straight dress with long sleeves, bow in the back, \$40/obo. 626/568-8298.

VEHICLES / ACCESSORIES

'83 BUICK station wagon, 50,000 miles, V8, tow bar, luggage rack, \$1,000/obo. 626/405-0338, Mike.

'89 CADILLAC Sedan DeVille, 4.5L V8, power all, salvage title, gray out/gray leather interior, \$3,000/obo. 830-0691.

CAR COVER made for Lexus ES300, bought from dealer with purchase of the car, \$75/obo. 626/568-8298.

'87 CHEVY Camaro, runs well, nice rims & new tires, 6 cycl., \$3,000. 626/794-1881.

'91 FORD Vision motor home, 53,000 miles, a/c, generator, awny, shower, luggage rack, microwave, new tires, carrier, fog lamps, double gas tanks w/85-gallon capacity, 2 double beds +

NOTICE TO ADVERTISERS

All housing and vehicle advertisements require that the qualifying person(s) placing the ad be listed as an owner on the ownership documents.

Universe

Editor

Mark Whalen

Photos

JPL Photo Lab

Universe is published every other Friday by the Public Affairs Office of the Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, CA 91109.

Advertising is a free service offered only to JPL, Caltech and contractor employees, retirees and immediate families.

Ads must be submitted on ad cards, available at the ERC and the Universe office, Bldg. 186-118, or via e-mail to universe@jpl.nasa.gov. E-mail ads are limited to six lines.

Ads are due at 2 p.m. on the Monday after publication for the following issue.

To change an address, contact your section's administrative assistant, who can make the change through the HRS database. For JPL retirees and others, call Xerox Business Services at (626) 844-4102.

more, \$25,000. 626/405-0338, Mike.

'85 FORD Mustang GT, v8 cond., built 302, brand new 5-spd., 3:55 gears, flowmasters, etc., serious only, \$4,500/obo. 790-6283.

'91 DODGE Ram 50 Le Sport, runs great, a/c, Alpine CD player/stereo system, pickup shell, bed liner, stick shift, 101K miles, very well maintained with records, \$3,900. 626/292-1760.

'91 DODGE Ram van LE, original owners, 8 passenger, p/b,p/s/p/w, a/c, cruise control, 318 eng. smoke free, very clean, \$6,800/obo. 626/797-8562.

'89 DODGE Grand Caravan LE, 3.0L, loaded inc. rear air, good tires, clean, one owner, complete repair records, mechanical work needed, 147k mi., \$3,200/obo. 790-4860.

'91 HONDA Prelude 2.0 Si, white, 5 speed, exc. condition, am/fm/CD, moon roof, power locks and windows, alarm, 120k miles, \$7,600. 626/963-7197.

'87 HONDA Accord DX coupe, blue, exc. running cond., \$2,500. 365-3799, Dave or Lucy.

'87 HONDA Accord LXi, 5 speed, sunroof, alarm, 4 doors, alloy wheels, good cond., 190K mileage, \$2,200/obo. 909/902-1025.

'93 MAZDA Miata, auto, convertible, exc. cond., \$12,000. 957-2421, after 6 p.m.

'98 NISSAN 200SX, exc. condition, 3,017 miles, 1 owner, CD player, \$16,000/obo. 909/949-2239, Lynn.

'95 NISSAN XE King Cab, 5 speed, A/C, chrome pkg., alpine cass., 6 changer CD, upgraded Pathfinder rims and tires, 47,100 miles, garaged, teal, exc. cond., \$8,600/firm. 626/441-3497.

'84 NOMAD travel trailer, new tires, sleeps 6, fully self-contained with a/c, stove, shower, heater, etc., battery fairly new also, \$3,000/obo. 626/798-6248.

'85 OLDSMOBILE Cutlass Supreme coupe, V8 5.0, new paint, exc. cond., pwr windows, brakes, cruise, etc.; new a/c compressor, new radiator & alternator, just serviced trans., \$3,195/obo. 248-2446, Mike.

'77 PONTIAC Trans Am, V8, 6.6L, auto, a/c, good cond., reliable, \$1,700/obo. 790-6283.

'90 SKAMPER pop-up tent trailer, sleeps 5, sink and propane fridge, toilet and electrical wiring included. 626/358-1786.

'95 TOYOTA Previa, super charge, 39K miles, exc. cond., 4 new tires, am/fm/stereo cass., power steering/windows/locks, dual air bags, a/c, alarm, \$16,000. 626/286-4768.

'91 TOYOTA Camry, 4 door, auto, 85K, A/C, am/ fm/CD, new brakes, PS/PB, alarm, remote entry, exc. cond., \$6,500/obo. 909/624-3181.

'91 TOYOTA Tercel, auto, a/c, d-r., ~130K miles, am/fm/cass., blue gd. cond., \$3,600. 714/577-8129.

FREE

DOG, 1/2 Akita-1/2 Shepherd, 3-yr.-old male, good with children & cats, not with poultry/goats, "Buster" is very friendly and must find a good home with fenced yard. 760/373-2512.

DOGS, 2 female dogs & 6 pups need adoption; 9-mo.-old female alive now; pups/mom (18 mo. old) avail. May; both adults housebroken, vaccinated, 25 lbs. 243-8891, eves. or lv. msg.

WATER HEATER, nat. gas (converted from propane), 60 gal., small leak at bottom of tank, you pick up, Lancaster/Palmdale area. 760/373-2512.

WANTED

BABY CLOTHES (girl's) sizes 12-18 mo.; firewood. 626/303-2633.

CRAFTERS, local, for "Craft Faire" in Arcadia Oct. 1-3. 626-797-1310, lv. msg. w/name, address and zip; info. mailed to you.

HOUSE in La Canada, 3-bd., to rent/lease, responsible JPL family. 626/794-2758, Betsy Wilson.

HOUSE for rent needed by visiting professor to JPL: will visit from Germany with his family Sept. 1, '99 - Feb. 28, '00; needs 3 bd. or more. Chris, e-mail: klingen@esprit.wir.uni-heidelberg.de.

HOUSEKEEPER, light care and housework for elderly woman, preferably mornings; just had knee surgery and needs assistance; references required. 626/798-0033, Denise.

HOUSE SITTER in Kailua-Kona, Hawaii for about 3 months this spring/summer (schedule is negotiable); up to 2 people; responsible adults only; very comfortable house across street from beach; private pool; will be responsible for watering, for feeding and walking small dog and for feeding cat and ko; references req. 626/584-9632.

PICKUP TRUCK, Toyota. 626/446-6437.

ROOMS OR APARTMENTS: JPL's Educational Affairs Office seeks employees who have rooms/apartments (preferably furnished) available for rent to out-of-state summer interns; duration is approx. 10-12 weeks (May 24-Oct. 12); contact Juliet Ellis at ext. 4-0726.

SPACE INFORMATION/memorabilia from U.S. & other countries, past & present. 790-8523, Marc Rayman.

SUMMER RENTAL for professor with a JPL appointment, needs a 3-bd., 2-ba. house, apartment, townhouse, or condo for family of five (children ages 11, 7, and 4); partially or fully furnished, house sitting is ideal; parking for one car; dates start betw. May 30 - June 12 and end betw. Aug. 7-14. 651/638-6334 (612/754-5318 home) or b-beecken@bethel.edu, Brian Beecken.

VANPOOL RIDERS, #3 from Fontana, Rancho Cucamonga, Upland, Claremont, La Verne area to JPL main facility. Ext. 4-8343, Mike Taylor or 4-5831, Rhea Clearwater.

FOR RENT

ALTADENA, rear house, 1 bd., 1 ba., small kitchen, fenced yd., off-st. parking, pets OK, \$500. 626/398-8109.

ALTADENA rm, quiet, non-smoking/drinking, \$280. 626/398-8109.

AZUSA, master bd. in house; room has phone jack, own shower & toilet, huge closet, A/C; house has cent. heat, storage, neat roommate; house is squeaky clean, din. rm, living room, big front and back yard; \$ 450 + utilities. 626/857-9402, Rani Kamarga.

CALTECH area, rear guest house in a park like garden, clean 1

lg. bd., full ba., lg. living room and kitchen, central air/central heating, stove provided; total 750 sq. ft., \$785. 626/304-0843, Alice.

LA CRESCENTA guest quarters w/private entrance & parking, 1-bd. suites incl. living rooms, dining rooms, min. kitchen fac., private patios & laundry, cent. a/c, all utilities and cable, no smoking or pets, shared cost \$650/\$850. 957-2173.

MONROVIA townhouse, 2 bd., 1.5 ba., dishwasher, washer & dryer, central air and heat, cable-ready, fireplace in living room, large priv. patio off master bd., fenced backyard, attached 2-car garage; 2 stories, 1,100 sq. feet; small 18-unit complex with pool and spa, nice quiet area off Foothill Blvd.; \$1,050 + \$1,050 security deposit, minimum 1-yr lease preferred; available starting July. 626/357-7583.

MONROSE, roommate wanted to share 2-bd. apt., 5 minutes from JPL, \$370 + 1/2 util. 541-0794.

SOUTH PASADENA, fully furnished studio apartment, nice area at 1718 Huntington Dr. between Marengo and Milan; units on 1 level, parking space, laundry facilities on premises, utilities paid, non-smoker, no pets; \$565. 626/792-9053, Marilyn.

PASADENA apt., 2 bd., lanai, garage, laundry rm., a/c, stove, garb. disposal, carpets, miniblinds, gd. closet/cabinet space, outdoor lighting; gardener, water and trash pd.; great area, Sierra Madre Bl. near California, close to Caltech; \$855. 805/967-7725.

PASADENA condo, 2 bd., 2 ba., security bldg., quiet, spacious, 2nd level, Sierra Madre Blvd., \$895, rent to own, first 6 mo. rent can be used as purchase down payment. 626/584-6526.

REAL ESTATE

BIG BEAR, new cabin 2 blocks from lake, 2 bd., 2 ba., mud/laundry room, \$129,000. 909/585-9026.

LA CANADA, 3 bd., 2 ba. Spanish style home in uniquely private verdant setting; near Montrose shops, park with tennis ct.; solar water for house and spa; hardwood floors, Berber carpets, Corian kitchen, cul de sac; central heat/air; La Canada schools, \$385,000. 249-8088.

LA CRESCENTA ranch home, 8 rooms, 4 bd., 2 ba. + loft, 2 fireplaces, lots of storage, Glendale schools, lg. priv. park-like yd. w/pool, surrounded by trees, covered brick patio w/benches & gas bbq, attached double garage, on private drive, \$429,000. 248-1997.

SAN DIMAS, secluded Via Verde area, 4 bd., 3 ba., 3-car garage, marble floors, large landscaped backyard with automatic sprinkler system, barbecue area, Spanish fountain, automatic wireless outdoor lighting, palm trees, covered patio, red brick pathways/walls, built in 1988, \$500,000. 626/568-8298.

VACATION RENTALS

BIG BEAR cabin, pleasant, quiet area near village, 2 bd., sleeps 8, completely furnished, F/P, TV/VCR, \$75/night. 249-8515.

BIG BEAR, 7 mi. /slopes; full kitch., f/p, 2 bd., 1 ba., sleeps 6; reasonable rates; 2-nt. min.; no smokers, no pets; exc. hiking, biking, fishing nearby. 909/585-9026, Pat & Mary Ann Carroll.

BIG BEAR LAKE cabin, near ski area, shops, village, forest, lake; 2 bd., sleeps up to 6, fireplace, TV, VCR, phone, microwave, BBQ and more; JPL disc. price from \$65/night. 909/599-5225.

BIG BEAR LAKEFRONT lu. townhome, indoor pool/spa, nr. skiing, beaut. master bdrm. suite, sleeps 6. 949/786-6548.

CAMBRIA ocean-front house, exc. view, sleeps up to 4. 248-8853.

HAWAII, Kona oceanfront condo on Big Island of Hawaii; 1 bd., 1 ba., sleeps 4, 50 yards from ocean, two pools, private beach, all amenities and good restaurants nearby; week of July 9-16 only (timeshare), \$500/week. 790-8069.

HAWAII, Maui condo, NW coast, on beach w/ocean vw., 25 ft. fr. surf, 1 bd. w/loft, compl. furn., phone, color TV, VCR, microwave, dishwasher, pool, priv. lanai, slps. 4, 4/15-12/14 rate: \$95/nite/2, 12/15-4/14 rate: \$110/nite/2, \$10/nite/add'l person. 949/348-8047.

HAWAII, Oahu, certificate good for 1-2 adults, Sun., Mon., Tues. arrival, 4 nights accom., airfare not incl., \$200. 626/917-0231.

LAKE TAHOE, North Shore, 2 bd., 2-1/2 ba., sleeps 6-7, private sandy beach, great location, all amenities, pool, walk to golf course, fishing 150 yards from front door, great hiking, kayaking, river rafting, bike trails, 2 miles/casinos, JPL discount rate. 626/355-3886, Rosemary or Ed.

MAMMOTH, Snowcreek, 2 bd., 2 ba., + loft; sleeps 6-8; fully equip'd kitch. incl. microwave, D/W; cable TV, VCR, phone, balcony w/mtn. view, Jacz., sauna, streams, fishponds; close to Mammoth Creek; JPL discount. 626/798-9222 or 626/794-0455.

MAMMOTH condo, studio + loft, 2 ba., fireplace w/wood supplied, Jacuzzi, sauna, game rm., color cbl. TV/VCR, full kitchen w/microwave, terrace, view, amen. 714/870-1872.

MAMMOTH condo in Chamonix at lifts 7, 8, 16, 17; walk to Warming Hut, 2 bd., 2 full ba., slps. 6, fully eqpd. elec. kitch., microw. & extras, frplc./wood, color TV, VCR, FM stereo, o/d Jacz., sauna; gm., rc. & Indry. rms., walk to shops, lifts; spec. midwk. rates, summer rates begin May. 249-8524.

MAZATLAN, week of Oct. 11-18, 1-bd. condo, sleeps 6, on the beach, partial kitch., airfare not included, \$1,050. 626/917-0231.

OCEANSIDE, on the sand, charming 1 bd. condo, panoramic view, walk to pier or harbor, pool, spa, game rm., sleeps 4. 949/786-6548.

PACIFIC GROVE house, 3 bd., 2 ba., fp, cable tv/vcr, stereo/CD, well-eqpd. kitch. w/microw., beaut. furn., close to golf, beaches, 17 Mile Dr., Aquarium, Cannery Row, JPL discount. 626/441-3265.

ROSARITO BEACH condo, 2 bd., 2 ba., ocean view, pool, tennis, short walk to beach on priv. rd., 18-hole golf course 6 mi. away, priv. secure parking. 626/794-3906.

S. LAKE TAHOE Keys waterfront home, 4 bd., 3 ba., slps. 12+ , 2-lv. frplacs, decks overlk. priv. dock/ski lifts, gourm. kitch., bikes, boats, color TVs, VCR, ster. w/tape/disk, pools, hot tub & bch.; tennis, 10 min./skiing, casinos/golf, 1 hr./wine cntry; \$995/wk. hi seas. [15 June to 15 Sept; 22 Nov. to 1 March]; + \$90 clean fee; 3-day min. 626/578-1503, Jim Douglas.